# Pseudo Relatives vs. Relative Clauses: Greater Preference, Lower Costs

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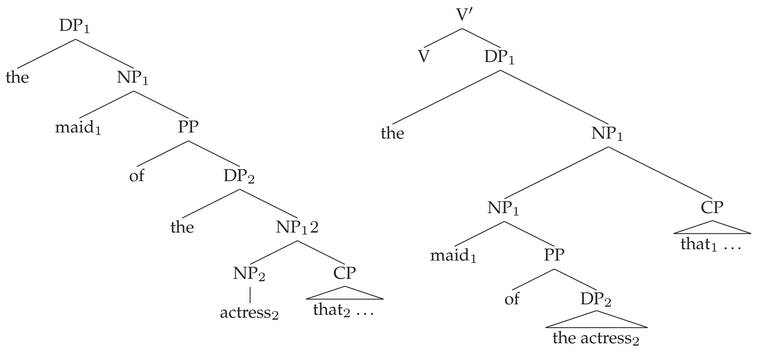
## RC Attachment Asymmetries

Variation in Relative Clause (RC) attachment preferences across languages has posed problems for a universal parser. (a,b) ([2], a.o.) :

Low Attachment, LA
a. Someone shot the maid$_1$ of the actress$_2$ that was standing on the balcony$_2$

High Attachment, HA
b. Algúien disparó contra la criada$_1$ de la actriz$_2$ que estava en el balcón$_1$

a. Low Attachment




b. High Attachment




A number of factors have been shown to influence attachment (including e.g. *syntactic position, prosody, referentiality, animacy*), and several accounts for the asymmetry have been proposed. However, there is a general consensus that none of them is fully satisfactory [5, a.o.].

## The PR Confound

Grillo & Costa (2012, 2014) [7]: In some languages and structures, apparent RCs can also be interpreted as Pseudo Relatives (PRs) (1-a).
PRs and RCs are string identical, but have very distinct structural and interpretive properties:

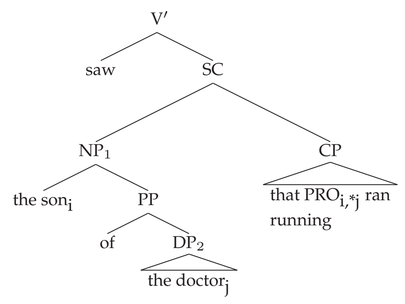
- RCs are adjuncts of NPs and denote properties of entities.
- PRs, like English eventive Small Clauses (SC) denote events (1-b).

(1) a. Ho visto [$_{PR}$ Gianni che correva].
Have.I seen [ Gianni that run.IMPF].
*I saw John that ran.
b. I saw [$_{SC}$ John running].

Contrary to RCs, PRs can only be selected by a restricted set of predicates, including e.g. perceptual (*see, hear*) but not stative predicates (*live with, be married to*).

→ Crucially, when PR is projected in complex NP contexts, DP2 is not an accessible subject :

(2) a. Ho visto [$_{SC}$ il figlio$_i$ del medico$_j$ che EC$_{i/*j}$ correva]
b. I saw [$_{SC}$ the son$_i$ of the doctor$_j$ running$_{i/*j}$]




### PR-first Hypothesis (Grillo & Costa 2014):

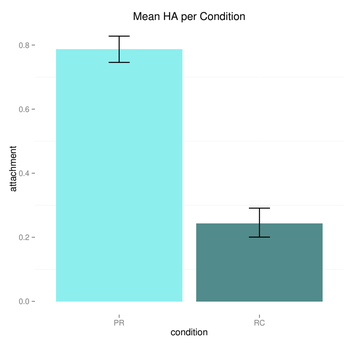
- When PRs are available, everything else being equal (e.g. lexical, contextual and prosodic factors), they will be preferred over RCs.
- Rationale: PRs (predicational) are both structurally and interpretively simpler than RCs (restrictive).
- Consequences:

A. Low Attachment preference with genuine restrictive RCs, i.e. when PRs not available, across languages and structures.
B. High Attachment preference in languages and structures which allow PR.

PR-first correctly applies to Basque, Chinese, Dutch, English, European Portuguese, French, Galician, Greek, Italian, Korean, Japanese, Romanian, Serbo-Croatian, Spanish. The apparently problematic HA preference in German, Bulgarian and Russian can be reduced to independent principles such as *Anaphoric Binding* (Hemforth et al. 2000) and *Implicit Prosody* (Fodor 1998a,b, 2002).

Grillo and Costa 2014 [7] directly manipulated PR availability through verb type: event-introducing (PR ok) vs. states-introducing (*PR) Verbs (e.g. *see* vs. *live with*). The results are strongly supportive of *PR-first*:

| PR | RC-Only |
|---|---|
| 78.6% | 24.2% |




Similar results were also obtained in other PR-languages, including **Portuguese** and **Spanish** (Grillo, Fernandes and Costa 2012, Fernandes 2012, Grillo, Tomaz, Lourenço Gomes and Santi 2013), **Greek** (Grillo and Spathas 2014) and **French** (Grillo, Pozniak, Hemforth and Santi, in preparation).

## Experiment 1: Full Relatives

PR-availability, however, covaries with the semantics of the main predicate (e.g., perceptual vs. stative). Factors other than PRs (including argument structure, event structure, and plausibility) could potentially be invoked to explain the results.

*PR-first*: significantly smaller effect of PR-availability in English than Italian.

Goal Assess whether predicate distinction alone can alternatively account for prior results by testing a non-PR language, English.

To test the role of PR-availability in attachment preferences we manipulated:

i. PR availability in the verbal domain contrasting event-introducing (✓PR) vs. states-introducing (*PR) predicates (e.g. *see* vs. *live with*)
ii. PR availability in the nominal domain contrasting event-introducing nouns (✓PR) vs. object denoting nouns (*PR) (e.g. *picture* vs. *house*).

*Method*: Questionnaire, PC running *Linger* (Doug Rodhe, http://tedlab.mit.edu/dr/Linger). *Participants*: (n=30) English Speakers. *Materials and Design*: 2x2 crossing *Verb Type*(PR and noPR) and *position* (object vs. subject); 24 sets of target sentences (4 versions each), 70 fillers; Counterbalanced materials and questions.

*Stimuli*

A. *PR predicate / Verbal* RC-only
John heard the teacher of the boy that was singing.

B. *PR predicate / Nominal* RC-only
The film of the teacher of the boy that was singing is of low quality.

C. *RC-only predicate / Verbal* RC-only
John runs with the teacher of the boy that was singing.

D. *RC-only predicate / Nominal* RC-only
The jacket of the teacher of the boy that was singing is red.

### RESULTS

#### Attachment Preference

Table 1: Mean % HA

| PR NP | PR VP | RC NP | RC VP |
|---|---|---|---|
| 32.5% | 37.2% | 28.4% | 19.5% |

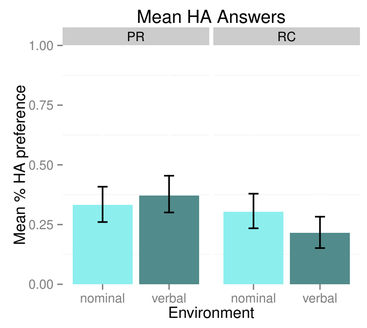



Table 2: Results of linear mixed model fit for Attachment Preferences in Experiment 1. Items and participants were crossed random factors.

| contrast | coefficient | SE | z-value | p-value |
|---|---|---|---|---|
| Predicate Type | 0.7387 | 0.2183 | 3.384 | 0.000714 *** |

→ Overall LA across all conditions! (Contrary to Italian).

Nonetheless: Significant effect of *V-type*: Higher proportion of HA in PR-compatible than RC-only.

#### Response Time

Table 3: Mean RT per Condition

| PR | RC |
|---|---|
| 3508.281 | 4041.976 |

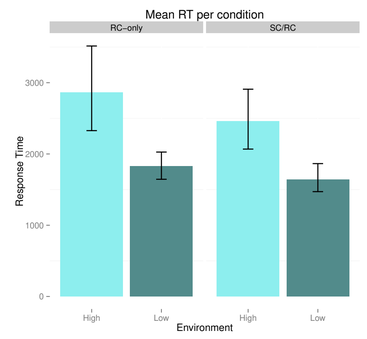



Table 4: Results of linear mixed model fit for RTs. Items and participants were crossed random factors.

| contrast | Estimate | SE | t-value |
|---|---|---|---|
| PR vs. RC | 0.092282 | 0.026429 | -3.49 |

→ Significant effect of *Attachment*: Significantly shorter RTs for LA choices than HA choices across all conditions.

## Experiment 2: Reduced Relatives

Goal: *Can we take a LA language such as English and generate HA preferences by manipulating SC availability?*

Means: *Small Clauses of the Accusative+progressive* -ing *type* [Acc-*ing*] the English homologue of PRs (see Declerck 1982, Cinque 1992, Rafel 1999). As with PRs:

i. Perceptual predicates introduce ambiguity between SC and reduced RC (3-a,b).

ii. SCs disallowed with Stative Verbs (3-c) and Object Nouns (3-d) with which only RCs survive.

To test the role of SC-availability in attachment of Reduced RCs we manipulated:

*Method*: Questionnaire, PC running *Linger* (Doug Rodhe, http://tedlab.mit.edu/dr/Linger). *Participants*: (n=30) English Speakers. *Materials and Design*: 2x2 crossing *Verb Type*(PR and noPR) and *position* (object vs. subject); 24 sets of target sentences (4 versions each), 70 fillers; Counterbalanced materials and questions.

*Stimuli*

A. *PR predicate / Verbal* SC/RC
John heard the teacher of the boy singing.

B. *PR predicate / Nominal* SC/RC
The film of the teacher of the boy singing is of low quality.

C. *RC-only predicate / Verbal* RC-only
John runs with the teacher of the boy singing.

D. *RC-only predicate / Nominal* RC-only
The jacket of the teacher of the boy singing is red.

### RESULTS

#### Attachment Preference

| PR NP | PR VP | RC NP | RC VP |
|---|---|---|---|
| 56.1 | 55.5 | 13.8 | 21.1 |

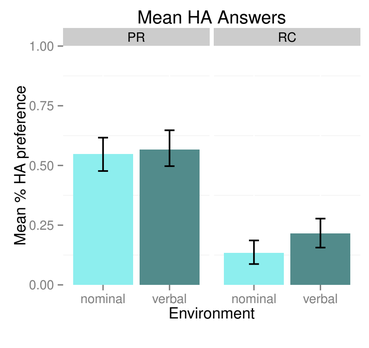



Table 5: Results of linear mixed model fit for Attachment Preferences in Experiment 1. Items and participants were crossed random factors.

| contrast | coefficient | SE | z-value | p-value |
|---|---|---|---|---|
| Predicate Type | 2.3894 | 0.3238 | 7.380 | 1.58e-13 *** |

→ Significant effect of *V-type*: Higher proportion of HA in SC than RC-only

#### Response Time

Table 6: Mean RT per Condition

| PR | RC |
|---|---|
| 3508.281 | 4041.976 |

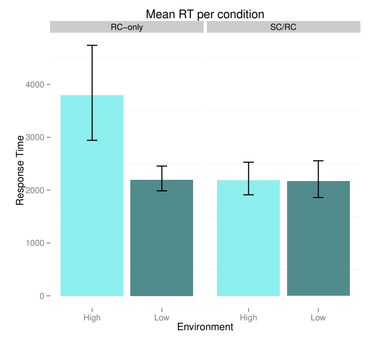



Table 7: Results of linear mixed model fit for RTs. Items and participants were crossed random factors.

| contrast | Estimate | SE | t-value |
|---|---|---|---|
| Predicate Type | -0.09584 | 0.02097 | -4.57 |
| Attachment | -0.07816 | 0.02100 | -3.72 |
| Predicate Type*Attachment | 0.18952 | 0.04201 | 4.51 |

→ Significant effect of *Attachment*: Significantly shorter RTs for LA choices than HA choices across all conditions.
→ Further evidence of overall LA preference with full RCs.

## Comparison

To directly test this greater effect of grammar over predicate semantics, we ran a mixed model logistic regression adding *Experiment* to *predicate-type* and *Environment* as fixed factors, with random slopes and intercepts fit for the fixed effect.

#### Attachment Comparison

| contrast | coefficient | SE | z-value | Pr(>\| z \|) |
|---|---|---|---|---|
| Predicate Type | 1.50065 | 0.18544 | 8.092 | 5.85e-16 *** |
| Predicate Type*Experiment | -1.55802 | 0.36040 | -4.323 | 1.54e-05 *** |
| Predicate Type*Environment*Experiment | 1.25753 | 0.56927 | 2.209 | 0.0272 * |

→ Stronger HA preference in the PR-compatible condition in Experiment II (SC/reduced RCs) than Experiment I (full RCs).

→ Stronger HA preference in the nominal/RC-Only in Experiment I than II (RC-Length: Implicit Prosody [6]).

#### RT comparison

| contrast | coefficient | SE | t-value |
|---|---|---|---|
| Predicate Type*Attachment*Experiment | 0.14135 | 0.06378 | 2.22 |

→ HA induces significantly longer RTs than LA but only for the RC-only condition across experiments. RTs for HA/LA do not differ in SC-compatible environments.

## Acknowledgements

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## Conclusions

- No overall HA in nonPR language with full RCs!
- Lexical semantics (event structure, argument structure) or plausibility alone cannot explain the asymmetry between results in PR languages and nonPR languages.
- This demonstrates the central (*not exclusive!*) role of PR-availability in explaining asymmetries in RC-attachment.
- When SC analysis is available, HA emerges even in LA languages such as English.
- Attachment preferences are not *language dependent*, but are crucially dependent on *universal* grammatical factors, such as the availability of a Small Clause reading (among other universal factors such as *prosody, referentiality* etc.).
- Results partly explain relative weak LA in previous English studies (∼ 60%).